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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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21005 7590 06/21/2007 HAMILTON, BROOK, SMITH & REYNOLDS, P.C. 530 VIRGINIA ROAD P.O. BOX 9133 CONCORD, MA 01742-9133			EXAMINER WANG, EUGENIA	
			ART UNIT 1745	PAPER NUMBER
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/530,002	Applicant(s) UENSAL ET AL.	
	Examiner Eugenia Wang	Art Unit 1745	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on April 17, 2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 29-58 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 29-58 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Response to Amendment

1. In response to the amendment received on April 17, 2007:
 - a. Claims 29-58 are pending
 - b. The stylistic changes to the Specification are acknowledged, and thus the previous objection to the specification is withdrawn.
 - c. The claim objection is withdrawn in light of the amendment.
 - d. The previous 112 rejections are withdrawn in light of the amendments.
 - e. A new rejection is made in light of the amendment, thus this action is final.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. Claims 29-58 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Claims 29, 54, and 57 say that step B is optional, however there is no support in the specification that this step is optional. The specification states "In one variant of the process, the heating according to step B) can be carried out after the formation of a sheet-like structure according to step C)." (p 35, line 1-2 of the amended Spec). However, the claim language opens the product to a

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process that is not heated, which is not supported by the specification. Examiner suggests rewording the claim, such that the heating limitation is expressed correctly. Since claims 30-53, 55, 56, and 58 are dependent on claim 29, 54, or 57 and do not rectify the issue, they are rejected as well.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 29-34, 36, 41-43, 47-50, and 52-58 are rejected under 35 U.S.C. 102(b) as being anticipated by US Patent Publication 2004/0062969 (Sakaguchi et al.). (This patent publication is used as a intermediate translation of PCT/JP01/09885, which was published on 5/16/02.).

Regarding claims 29, 54, 56, and 57 Sakaguchi et al. teaches a path for synthesizing a polybenzazole compound having a phosphono group to be used as electrolyte film for a fuel cell. The path begins with selecting a compound out of a first grouping, the listed group including aromatic tetramines, and a second compound out of a group consisting of aromatic dicarboxylic acid and their derivatives (paragraph 0091). Additionally, the aromatic dicarboxylic acids can have a phosphonic acid group (paragraph 0092, lines 1-4). The polybenzazole compound having the phosphonic acid group can be synthesized with the two aforementioned precursors by dehydration and cyclizing polymerization with a solvent of polyphosphoric acid (paragraph 0110, lines 1-

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11). Afterwards the polybenzazole compound having the phosphonic acid group is added to a resin, which is later cast on a glass or Teflon plate (paragraph 206, lines 1-5; paragraph 0207, lines 6-8). The inventive polymer is then solidified and can be used as a membrane (paragraph 0210). Additionally, the composition containing the inventive polybenzazole compound having the phosphonic acid group can be used in a fuel cell assembly, where the solid polymer and electrode catalytic layers are bonded to both surfaces thereof as a component of the solid polymer electrolyte membrane/electrode assembly (as applied to claims 54, 56, and 57) (paragraph 0214). Methods of forming the electrolyte membrane/electrode assembly include hot-pressing with a catalytic metal and a binder, spraying the polymer electrolyte with the inventive polybenzazole compound with the sulfonic/phosphonic acid group to a gas-diffusion electrode and then joining the two, hot-pressing a membrane with a prepared pastes with the polymer electrolyte and catalyst, applying the electrolyte paste and drying (as applied to claims 54, 56, 57) (paragraphs 0227-0229). Sakaguchi et al.'s membrane/electrode assembly also states an inventive property in which both the solid polymer electrolyte membrane and the electrode catalytic layers are preferably mainly composed of the inventive polybenzazole compound having sulfonic/phosphonic acid group (as applied to claim 57) (paragraph 0217). As to step B) of claims 29, 54, and 57, Sakaguchi et al. mentions that heat can be applied during the reaction and that the optimum temperature depends on the combination of monomers (paragraph 0113, lines 3-4). Additionally, Sakaguchi et al. talks about a drying atmosphere during a heating phase using air or inert gas (paragraph 210, lines 7-9). In a different heating part of the process, Sakaguchi et al.'s

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reaction is said to be carried out at a high temperature, and the reaction temperature is preferably lowered in the range capable of attaining the effects of the invention (paragraph 0113, lines 7-10). Therefore, Sakaguchi et al.'s product is the same as the one in the claimed invention. However, as mentioned in the claim language, step B is taken to be optional (as step C can be applied to either A and/or B). Additionally, the heating temperature and atmosphere mentioned in step B can be varied, as long as the process still produced the proton-conducting polymer membrane comprising of polyazoles containing sulfonic acid groups as claimed in the preamble.

"[E]ven though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." In re Thorpe, 777 F.2d, 698, 227 USPQ 964, 966 (Fed. Cir. 1985)(citations omitted).

"The Patent Office bears a lesser burden of proof in making out a case of prima facie obviousness for product-by-process claims because of their peculiar nature" than when a product is claimed in the conventional fashion. In re Fessmann, 489 F.2d 742, 744, 180 USPQ 324, 326 (CCPA 1974). Once the Examiner provides a rationale tending to show that the claimed product appears to be the same or similar to that of the prior art, although produced by a different process, the burden shifts to applicant to come forward with evidence establishing an unobvious difference between the claimed product and the prior art product. In re Marosi, 710 F.2d 798, 802, 218 USPQ 289, 292

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(Fed. Cir. 1983). Ex parte Gray, 10 USPQ2d 1922 (Bd. Pat. App. & Inter. 1989). See MPEP section 2113.

The teachings of Sakaguchi et al. as applied to claims 29 and 54 have been set forth above and are herein incorporated with regards to claims 29-34, 36, 41-43, 47-50, 52, 53, 55, and 58.

As to claim 30 and 32, the tetraamino compound in the form of formulas (A) and (C), respectively, is not specifically mentioned. Examples given in paragraph 0093 do not make note of the Y_pZ_r portion of formula (A) or the $Y_pZ'_r$ portion of formula (C). However, derivatives can be used as well, and specific examples of the derivatives of the tetraamines that can be used include salts with acids including *phosphoric* and *sulfuric* acid (applied to claims 30 and 32, respectively), which accounts for the Z portion and may include the Y_p portion as well (paragraph 0094, lines 1-4). Additionally, formulas (A) and (C) are intermediates of the final product mentioned in claim 26. The final product would still include the phosphonic acid group. See MPEP section 2113.

As to claims 31 and 34, an example of the aromatic and or/heteroatomic carboxylic acid is 2,5-dicarboxyphenylphosphonic acid (paragraph 0101, lines 8-9). This example shows the claimed form (B) except for the fact that "p" is zero. However, derivatives of the phosphonic acid can be used (paragraph 0101, lines 10). A carbon chain, as represented by Y_p , added to the phosphonic acid group would be a derivative of the aforementioned phosphonic acid group. Additionally, this formula (B) is an intermediate of the final product mentioned in claim 29. Z_r is still present in Sakaguchi et al.'s teaching and would be used to form the polymer with the phosphonic acid group.

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See MPEP section 2113. Additionally the aromatic and/or heteroaromatic tetraaminos given for examples do not have a phosphonic acid group, as can be seen by one compound given as an example: 1,2,4,6-tetraaminobenzene (as applied to claim 34)

As to claim 33 an example of the aromatic and or/heteroatomic carboxylic acid is 2,5-dicarboxyphenylphosphonic acid (paragraph 0101, lines 8-9). The differences between this example and form (D) are (1) "p" is zero and (2) Z', is a phospho group rather than a sulfo group. However, Sakaguchi et al. also mention that dicarboxylic acid having sulfonic acid group and phosphonic acid group may be copolymerized to synthesize the polynebazole having sulfonic acid group and/or phosphonic acid group, which could represent the Y_pZ', portion of (D) (paragraph 0108). Therefore, Sakaguchi et al.'s aromatic carboxylic acid serves the same purpose as claim 33, which can be applied to the final product mentioned in claim 29. See MPEP section 2113.

Regarding claim 36, Sakaguchi et al. teach a membrane that uses of compounds such as terephthalic acid and 2,2-bis(4-carboxyphenyl-)hexafluoropropane for use of copolymerization for synthesizing polybenzazole (paragraph 0105, lines 1-7, 12, and 15-16).

As to claims 41, 42, and 43, Sakaguchi et al. teaches the use of dicarboxylic acids and Gerber teaches the use of tri and tetra carboxylic acids in the formation of polyazoles. Although specific percentages used for the reaction are not claimed, a certain amount polycarboxylic acid is needed for the reaction to provide the final product. See MPEP section 2113.

As to claims 47 and 49, Sakaguchi et al.'s process includes a heating portion after the inventive solution of polybenzazole with the sulfonic acid group is cast on the Teflon or glass plate (paragraph 0210). With respect to claim 49, the heating portion for drying the sheet is adjustable (paragraph 210, lines 3-2). Although no temperature is specifically given, the end product is the same, and the temperature is adjustable in order to optimize solvent removal and homogeneity of the composite. See MPEP section 2113.

As to claim 48, Sakaguchi et al. teaches an inventive resin molding containing the polybenzazole compound having the phosphonic acid group (paragraph 0195). Additionally, the solid polymer electrolyte membrane prepared by mixing a polymer other than the inventive polybenzazole compound having the phosphonic/sulfonic acid group may be employed as the polymer electrolyte membrane (paragraph 0221, lines 1-6). An example of a sulfonated polybenzoxazole compound being mixed with another polymer is shown in example 14, when the compound was later mixed with carbon black, which contains platinum and nafion (paragraph 0305).

Regarding claim 50, the treatment to get the membrane to be self supporting includes drying out the solvent. Although no specific time period is given by Sakaguchi et al., the speed is adjusted by adjusting the temperature to optimize homogeneity (paragraph 0210). Additionally, thickness would also effect the time. Discovery of optimum of result effective variable in known process is ordinarily within the skill of art. (In re Boesch, 205 USPQ 215 (CCPA 1980).) Selection of optimum ranges within the prior art's general condition is obvious. (In re Aller, 105 USPQ 233(CCPA 1955))

As to claims 52, 53, and 55, thickness ranges are given at different parts of Sakaguchi et al.'s process. The ranges given for the membrane after the cast is laid is between 10 μm and 1000 μm , preferably between 100 μm and 500 μm , which lies between the range claimed in 52 (paragraph 208). After the membrane is dried, as in step D, the thickness suggested should optimize ion conductivity and mechanical strength. A thickness mentioned that is preferable to both variables is 20 μm (as applied to claim 53) (paragraphs 0211, 0212). The thickness range for the solid polymer electrolyte membrane/electrode assembly, as applied to claim 55, is between 5 μm and 300 μm , preferably between 10 μm and 100 μm (paragraph 0223).

Regarding claims 58, Sakaguchi et al. teach the use of the polymeric material in a solid polymer electrolyte membrane, which is preferably employed in fuel cells (paragraph 0317, lines 1-7).

Response to Arguments

5. Applicant's arguments filed April 17, 2007 have been fully considered but they are not persuasive.

As to claims 29, 54, and 57, Applicant argues that step D) – the treatment of the membrane until it is self-supporting through the partial hydrolysis of the polyphosphoric acid moieties is neither explicitly, nor inherently encompassed by Sakaguchi et al..

Examiner respectfully holds the position that Sakaguchi et al. teaches what is claimed. Independent claims 29, 54, and 57 use alternative language (or), when describing the process of step A. The language of step A can be taken to be either (1) mixing one or more aromatic or heteroaromatic tetraamino compounds with one or more

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aromatic or heteroaromatic carboxylic acids or derivatives thereof which contain at least two acid groups per carboxylic acid monomer, with at least part of the tetraamino compounds or the carboxylic acids comprising at least one phosphonic acid group or (2) mixing of one or more aromatic heteroaromatic diaminocarboxylic acids, of which at least part comprises phosphonic acid groups, in polyphosphoric acid to form a solution or dispersion. As stated in the rejection for claims 29, 54, 56, and 57, part (1) of step A) is taught by Sakaguchi et al. Specific examples of aromatic tetramines can be found in paragraph 0093, and specific aromatic dicarboxylic acids having phosphonic acid groups (these have at least two acid groups per acid monomer) can be found in paragraph 0101. With the alternative language used within the claim, polyphosphoric acid is not required in part (1) of step A, and thus step D is not required either. Therefore the arguments with respect to partially hydrolyzing the polyphosphoric acid moieties until the membrane is self-supporting are moot.

Applicant argues that their invention is a proton conductive membrane, not merely the process of formation of the polymer or the polymer made up of specific monomers alone.

Examiner respectfully disagrees, as paragraph 0001 clearly states that the polybenzazole compound having sulfonic acid group and/or phosphonic acid group is used as the solid polymer electrolyte membrane for a membrane electrode assembly. Furthermore, in paragraph 0317 (lines 1-7), thus stating the same use as Applicant (since polymer membranes in fuel cells are inherently used for proton conduction).

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However, the polymer itself is materially the same as that of Applicant's and the membrane would be construed as intended use.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
 2. Ascertaining the differences between the prior art and the claims at issue.
 3. Resolving the level of ordinary skill in the pertinent art.
 4. Considering objective evidence present in the application indicating obviousness or nonobviousness.
6. Claim 35 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sakaguchi et al. in view of US Patent Application Publication 2001/0003130 (Matsuoka et al.).

The teachings of Sakaguchi et al. have been set forth above and are herein incorporated.

The difference between the teachings of Sakaguchi et al. and claim 35 is that none of the compounds 3,3',4,4'-tetraaminobiphenyl, 2,3,5,6-tetraaminopyridine, and/or 1,2,4,5-tetraaminobenzene are taught as being used as a polymeric precursor.

Matsuoka et al. teaches the preparation of polybenzazole and a polybenzazole fiber, which uses 1,2,4,5-tetraaminobenzene as a used to make the polybenzazole polymer (paragraph 0013; paragraph 0015, line 4). Sakaguchi et al. discloses the claimed invention except for using 1,2,5,5-tetraaminobenzene as a polymeric precursor.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to use this polymeric precursor, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

7. Claims 39, 40, 44, and 45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sakaguchi et al. in view of US Patent 3783137 (Gerber).

The previous teachings of Sakaguchi et al. have been discussed above and are herein incorporated.

As to claim 39, the difference between the teachings of Sakaguchi et al. and claim 39 is that the polymeric precursors do not mention the use of aromatic tricarboxylic acids, their C1-C20-alkyl esters or C5-C12-aryl esters or their acid anhydrides or their acid halides or tetracarboxylic acids, their C1-C20-alkyl esters or C5-C12-aryl esters or their acid anhydrides or their acid halides.

Gerber teaches a method of producing heterocyclic polymers. This type of polymer includes polybenzimidazole-type compositions (column 2, lines 61-63). It teaches the use of the prepolymer 1,4,5,8-naphthalenetetracarboxylic acid dianhydride,

which is an example of a tetracarboxylic acid anhydride as specified by claim 39 (column 13, lines 55-56).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to use this polymeric precursor, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

As to claim 40, the difference between the teachings of Sakaguchi et al. and claim 40 is that the polymeric precursors do not mention the use of 1,3,5-benzenetricarboxylic acid (trimesic acid), 2,4,5-benzenetricarboxylic acid (trimellitic acid), (2-carboxyphenyl)imondiacytic acid, 3,5,3'-biphenyltricarboxylic acid, 2,5,4'-biphenyltricarboxylic acid, 2,4,6-pyridinetricarboxylic acid, benzene-1,2,4,5-tetracarboxylic acid, (naphthalene-1,4,5,8-tetracarboxylic acid, 3,5,3',5'-biphenyltetracarboxylic acid, benzophenonetetracarboxylic acid, 3,3',4,4'-biphenyltetracarboxylic acid, 2,2',3,3'-biphenylcarboxylic acid and/or 1,2,5,6-naphthalenetetracarboxylic acid.

Gerber teaches a method of producing heterocyclic polymers. This type of polymer includes polybenzimidazole-type compositions (column 2, lines 61-63). Gerber also teaches that mixtures of tricarboxylic acids may be used as acid derivatives, or mixtures of the acids halides and acid anhydrides may be used in the process of the invention (column 5, lines 60-63). In example 4 of the invention, a heterocyclic prepolymer can be formed using trimellitic (2,4,5-benzenetricarboxylic) anhydride

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monoacid chloride, which falls under the category as an anhydride derivative of the tricarboxylic acid (column 11, lines 35-37).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to use this polymeric precursor, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

As to claims 44 and 45, the difference between the teachings of Sakaguchi et al. and claims 44 and 45 is that the polymeric precursors do not mention the use of heteroatomic dicarboxylic acids, tricarboxylic acids, and/or tetracarboxylic acids containing at least one nitrogen, oxygen, sulfur, or phosphorous atom in the aromatic, namely pyridine-2,5-dicarboxylic acid, pyridine-3,5-dicarboxylic acid, pyridine-2,6-dicarboxylic acid, pyridine-2,4-dicarboxylic acid, 4-phenyl-2,5-pyridinedicarboxylic acid, 3,5-pyrazoledicarboxylic acid, 2,6-pyrimidinedicarboxylic acid, 2,5-pyrazinedicarboxylic acid, 2,4,6-pyridinetricarboxylic acid, benzimidazole-5,6-dicarboxylic acid or their C1-C20-alkyl esters or C5-C12-aryl esters or their acid anhydrides or their acid chlorides.

Gerber teaches the use of diacid halides as a reactant to produced polybenzimidazoles (column 5, lines 15-15). It teaches the use of diacid hydrides derived from 3,5-pyridinedicarboxylic acid and 2,5-pyrazineinedicarboxylic acid.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to use the aforementioned acids, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of

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its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

8. Claim 51 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sakaguchi et al. in view of WO 01/87992, as evidenced by U.S. Patent No. 6,767,585 (Kerres et al.)

US 6,767,585 is being used as an intermediate translation of WO01/87992.

As to claim 45, the teachings of Sakaguchi et al. have been previously mentioned, and are herein incorporated. Sakaguchi et al. does not teach crosslinking of the polymer. Kerres et al. teaches the use of crosslinked polymers including polyzaoles (polybenzimidazole and polycarbazoles) (column 1, lines 10-11 and 40-41). These polymers membranes additionally may include basic groups, such as sulfonic acid groups and are further used in fuel cells (column 1, line 44-45). Although an oxygen-containing atmosphere for the stated crosslinking is not given, crosslinking is a product-by-process.

The motivation for crosslinking is to provide better mechanical stability, improved modulus of elasticity, higher tensile strength, improved swelling properties in order to be used in fuel cells that can run upward 100°C (column 2, lines 30-38). Therefore it would have been obvious to one having ordinary skill in the art at the time the claimed invention was made to modify the teachings of Sakaguchi et al. in order to include a crosslinking step to the process since the result would be in strengthening the membrane's mechanical stability, elasticity, tensile strength, and swell properties.

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Double Patenting

9. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

10. Claims 29-58 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 29-58 of copending Application No. 10/529993 in view of Sakaguchi et al.

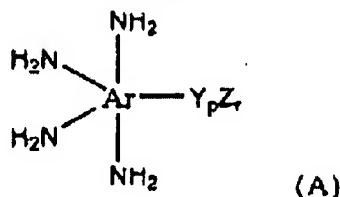
The claims of Application No. 10/529993 are listed below:

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26. (currently amended) A proton-conducting polymer membrane which comprises polyazoles containing sulfonic acid groups and is obtainable by a process comprising the steps:
- A) : mixing one or more aromatic or heteroaromatic tetraamino compounds with one or more aromatic or heteroaromatic carboxylic acids or derivatives thereof which contain at least two acid groups per carboxylic acid monomer, with at least part of the tetraamino compounds or the carboxylic acids comprising at least one sulfonic acid group, or mixing of one or more aromatic or heteroaromatic diaminocarboxylic acids, of which at least part comprises sulfonic acid groups, in polyphosphoric acid to form a solution or dispersion;
 - B) optionally heating the solution or dispersion obtained according to step A) under inert gas to temperatures of up to 325°C to form polyazole polymers;
 - C) applying a layer using the mixture from step A) or B) to a support, thus forming a membrane on the support; and
 - D) treating partially hydrolyzing the polyphosphoric acid moieties of the membrane from step C) until ~~it~~ the membrane is self-supporting.

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27. (Currently amended) The membrane of Claim 26, characterized in that the mixture prepared in step A) comprises aromatic or heteroaromatic tetraamino compounds of the formula (A):

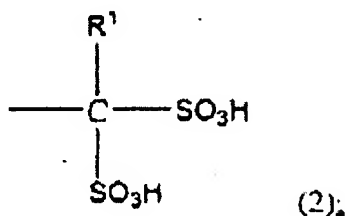


wherein

- Ar is an aromatic or heteroaromatic group;
 Y is a bond or a group having from 1 to 20 carbon atoms;
 p is an integer from 1 to 4 and represents the number of bonds or groups Y via which the group Z is bound to the group Ar;
 r is an integer from 1 to 4 and represents the number of groups Z which are bound to the group Y or, if Y is a bond, to the aromatic or heteroaromatic group Ar; and
 Z is a group of the general formula (1):



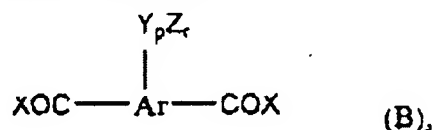
or the general formula (2):



wherein R¹ is a hydrogen atom or a group having from 1 to 20 carbon atoms.

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28. (currently amended) The membrane of Claim 26, characterized in that the mixture prepared in step A) comprises aromatic or heteroaromatic carboxylic acids of the formula (B):

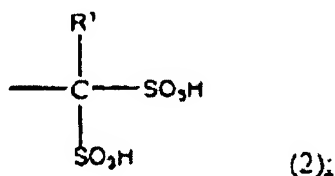


wherein

- Ar is an aromatic or heteroaromatic group;
 X is a halogen atom or a group of the formula OR^2 , where R^2 is a hydrogen atom or a group having from 1 to 20 carbon atoms;
 Y is a bond or a group having from 1 to 20 carbon atoms;
 p is an integer from 1 to 4 and represents the number of bonds or groups Y via which the group Z is bound to the group Ar;
 r is an integer from 1 to 4 and represents the number of groups Z which are bound to the group Y or, if Y is a bond, to the aromatic or heteroaromatic group Ar; and
 Z is a group of the general formula (1):



or the general formula (2):



wherein R' is a hydrogen atom or a group having from 1 to 20 carbon atoms.

29. (Previously Presented) The membrane of Claim 26, characterized in that the mixture prepared in step A) comprises aromatic or heteroaromatic tetraamino compounds which contain no sulfonic acid groups and

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aromatic or heteroaromatic carboxylic acids which contain at least one sulfonic acid group.

30. (Previously Presented) The membrane of Claim 26, characterized in that the mixture prepared in step A) comprises 3,3',4,4'-tetraaminobiphenyl, 2,3,5,6-tetraaminopyridine, or 1,2,4,5-tetraaminobenzene.
31. (currently amended) The membrane of Claim 26, characterized in that the mixture prepared in step A) comprises: isophthalic acid; terephthalic acid; phthalic acid; 5-hydroxyisophthalic acid; 4-hydroxyisophthalic acid; 2-hydroxyterephthalic acid; 5-aminoisophthalic acid; 5-N,N-dimethylaminoisophthalic acid; 5-N,N-diethylaminoisophthalic acid; 2,5-dihydroxyterephthalic acid; 2,5-dihydroxyisophthalic acid; 2,3-dihydroxyisophthalic acid; 2,3-dihydroxyphthalic acid; 2,4-dihydroxyphthalic acid; 3,4-dihydroxyphthalic acid; 3-fluorophthalic acid; 5-fluoroisophthalic acid; 2-fluoroterephthalic acid; tetrafluorophthalic acid; tetrafluoroisophthalic acid; tetrafluoroterephthalic acid; 1,4-naphthalenedicarboxylic acid; 1,5-naphthalenedicarboxylic acid; 2,6-naphthalenedicarboxylic acid; 2,7-naphthalenedicarboxylic acid; diphenic acid; 1,8-dihydroxynaphthalene-3,6-dicarboxylic acid; bis(4-carboxyphenyl) ether; benzophenone-4,4'-dicarboxylic acid; bis(4-dicarboxyphenyl) sulfone; biphenyl-4,4'-dicarboxylic acid; 4-trifluoromethylphthalic acid; 2,2-bis(4-carboxyphenyl)hexafluoropropane; 4,4'-stilbenedicarboxylic acid; 4-carboxycinnamic acid; or their C₁-C₂₀-alkyl esters or C₅-C₁₂-aryl esters, or their acid anhydrides or acid chlorides.
32. (Previously Presented) The membrane of Claim 26, characterized in that the mixture prepared in step A) comprises 2,3-diamino-5-carboxyphenylsulfonic acid, 2,3-diamino-6-carboxyphenylsulfonic acid, and 3,4-diamino-6-carboxyphenylsulfonic acid.

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33. (Previously Presented) The membrane of Claim 26, characterized in that the mixture prepared in step A) comprises aromatic tricarboxylic acids, their C₁-C₂₀-alkyl esters or C₅-C₁₂-aryl esters or their acid anhydrides or their acid halides or tetracarboxylic acids, their C₁-C₂₀-alkyl esters or C₅-C₁₂-aryl esters or their acid anhydrides or their acid halides.
34. (Currently Amended) The membrane of Claim 33, characterized in that the mixture prepared in step A) comprises 1,3,5-benzenetricarboxylic acid (trimesic acid); 2,4,5-benzenetricarboxylic acid (trimellitic acid); (2-carboxyphenyl)iminodiacetic acid, 3,5,3'-biphenyltricarboxylic acid; 3,5,4'-biphenyltricarboxylic acid; 2,4,6-pyridinetricarboxylic acid; benzene-1,2,4,5-tetracarboxylic acid; naphthalene-1,4,5,8-tetracarboxylic acid; 3,5,3',5'-biphenyltetracarboxylic acid; benzophenonetetracarboxylic acid; 3,3',4,4'-biphenyltetracarboxylic acid, 2,2',3,3'-biphenyltetracarboxylic acid, or 1,2,5,6-naphthalenetetracarboxylic acid or 1,4,5,8-naphthalenetetracarboxylic acid
35. (Previously Presented) The membrane of Claim 33, characterized in that the content of tricarboxylic acid or tetracarboxylic acids is in the range of from 0 to 30 mol% based on dicarboxylic acid used.
36. (Previously Presented) The membrane of Claim 35, characterized in that the content of tricarboxylic acid or tetracarboxylic acids is in the range of from 0.1 to 20 mol% based on dicarboxylic acid used.
37. (Previously Presented) The membrane of Claim 36, characterized in that the content of tricarboxylic acid or tetracarboxylic acids is in the range of from 0.5 to 10 mol% based on dicarboxylic acid used.
38. (Previously Presented) The membrane of Claim 26, characterized in that the mixture prepared in step A) comprises heteroaromatic dicarboxylic

acids, tricarboxylic acids or tetracarboxylic acids which contain at least one nitrogen, oxygen, sulfur, or phosphorus atom in the aromatics.

39. (Currently amended) The membrane of Claim 38, characterized in that the mixture prepared in step A) comprises pyridine-2,5-dicarboxylic acid;₂ pyridine-3,5-dicarboxylic acid;₂ pyridine-2,6-dicarboxylic acid;₂ pyridine-2,4-dicarboxylic acid;₂ 4-phenyl-2,5-pyridinedicarboxylic acid;₂ 3,5-pyrazoledicarboxylic acid;₂ 2,6-pyrimidinedicarboxylic acid;₂ 2,5-pyrazinedicarboxylic acid;₂ 2,4,6-pyridinetricarboxylic acid;₂ benzimidazole-5,6-dicarboxylic acid;₂ or their C₁-C₂₀-alkyl esters or C₃-C₁₂-aryl esters or their acid anhydrides or their acid chlorides are used.
40. (Currently Amended) The membrane as claimed in claim 26, characterized in that the mixture prepared in step A) comprises diaminobenzoic acid or its monohydrochloride and dihydrochloride salts derivatives.
41. (Previously Presented) The membrane of Claim 26, characterized in that the heating according to step B) is carried out after the formation of a sheet-like structure according to step C).
42. (Previously Presented) The membrane as claimed in claim 26, characterized in that the solution produced in step A) or step B) further comprises dispersed or suspended polymer.
43. (Previously Presented) The membrane of Claim 26, characterized in that the treatment according to step D) is carried out at temperatures in the range of from 0°C to 150°C in the presence of moisture.
44. (Previously Presented) The membrane of Claim 26, characterized in that the treatment of the membrane in step D) is carried out from 10 seconds to 300 hours.

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45. (Previously Presented) The membrane of Claim 26, characterized in that the membrane formed after step D) is crosslinked by action of oxygen.
46. (Previously Presented) The membrane of Claim 26, characterized in that a layer having a thickness of from 20 to 4000 μm is produced in step C).
47. (Previously Presented) The membrane of Claim 26, characterized in that the membrane formed after step D) has a thickness of from 15 to 3000 μm .
48. (Currently amended) An electrode having a proton-conducting polymer coating which is based on polyazoles and is obtainable by a process comprising the steps:
- A) mixing one or more aromatic or heteroaromatic tetraamino compounds with one or more aromatic or heteroaromatic carboxylic acids or derivatives thereof which contain at least two acid groups per carboxylic acid monomer, with at least part of the tetraamino compounds or the carboxylic acids comprising at least one sulfonic acid group, or mixing of one or more aromatic or heteroaromatic diaminocarboxylic acids, of which at least part comprises sulfonic acid groups, in polyphosphoric acid to form a solution or dispersion;
 - B) optionally heating the solution or dispersion obtained according to step A) under inert gas to temperatures of up to 350°C to form the polyazole polymer;
 - C) applying a layer using the mixture from step A) or B) to an electrode, thus forming a membrane on the electrode; and
 - D) heating partially hydrolyzing the polyphosphoric acid moieties of the membrane from step C).
49. (Previously Presented) The electrode of Claim 48, wherein the coating has a thickness of from 2 to 3000 μm .

50. (Previously Presented) A membrane-electrode unit comprising at least one electrode and at least one membrane as claimed in Claim 26.
51. (Currently Amended) A membrane-electrode unit comprising at least one electrode having a proton-conducting polymer coating which is based on polyazoles and is prepared by the following steps ~~obtainable by a process that includes the steps~~
- A) mixing one or more aromatic or heteroaromatic tetraamino compounds with one or more aromatic or heteroaromatic carboxylic acids or derivatives thereof which contain at least two acid groups per carboxylic acid monomer, with at least part of the tetraamino compounds or the carboxylic acids comprising at least one sulfonic acid group, or mixing of one or more aromatic or heteroaromatic diaminocarboxylic acids, of which at least part comprises sulfonic acid groups, in polyphosphoric acid to form a solution or dispersion;
 - B) optionally heating the solution or dispersion obtained according to step A) under inert gas to temperatures of up to 350°C to form the polyazole polymer;
 - C) applying a layer using the mixture from step A) or B) to an electrode, thus forming a membrane on the electrode; and
 - D) ~~treating partially~~ hydrolyzing the polyphosphoric acid moieties of the electrode membrane from step C) until the membrane is self-supporting, and partially hydrolyzing the polyphosphoric acid moieties of at least one membrane as claimed in Claim 26
- 52 (Currently amended) A fuel cell comprising one or more membrane-electrode units as claimed in Claim ~~51~~ 50.

Sakaguchi et al. teaches a polybenzazole with sulfonic acid or phosphonic acid groups. Both groups exhibit excellent processability, durability, solvent resistance,

mechanical properties, and ion conductivity where both acid groups satisfy the object of the invention of creating a polymer membrane (paragraph 0022). Since Sakaguchi et al. teaches the fact that sulfonic and phosphonic acid groups on the polybenzazole induces similar properties and achieves the same goals, the Application 10/530002 is double patenting, since the differences between claims of the two applications are the substitution of phosphonic acid groups for sulfonic acid groups.

Copending claim 26 reads on the currently considered claim 29. The only differences are: (1) step B of copending claim 26 heats to 325°C, while currently considered claim 29 heats to 350°C and (2) the polyazole polymer membrane of copending claim 26 includes sulfonic acid groups, while currently considered claim 29 includes phosphonic acid groups (as in the preamble and step A)). Step B) in both the copending and currently considered claim provide the same function (to form the polymer). Additionally the final product has the same properties. As previously mentioned both groups exhibit excellent processability, durability, solvent resistance, mechanical properties, and ion conductivity where both acid groups satisfy the object of the invention of creating a polymer membrane (paragraph 0022).

Copending claim 27 reads on currently considered claims 30 and 32. The tetraamines described in (A) (copending 27 and currently considered 30) and (C) (currently considered 32) have the same generic form. The difference exists in the Z groups in each respective claim. The Z group in currently considered claim 30 has phosphoric acid groups. The Z group in currently considered claim 32 has sulfuric acid groups. The Z group in copending claim 27 has a sulfuric acid group. Sakaguchi et al.

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lists tetraamines used to synthesize polymers that can be used to make the polybenzazole compound having sulfonic acid group and/or phosphonic acid group (paragraph 0093). Additionally listed is the fact that derivatives of the tetraamines can be used as well, including salts with acids including sulfuric acid and phosphoric acid (paragraph 0094, lines 1-4). Therefore copending claim 27 and currently considered claims 30 and 32 cover the same scope.

Copending claim 28 reads on currently considered claims 31 and 33. The aromatic/heteroaromatic carboxylic acids described in (B) (copending 28 and currently considered 31) and (D) (currently considered 33) have the same generic form. The difference exists in the Z groups in each respective claim. The Z group in currently considered claim 31 has phosphoric acid groups. The Z group currently considered claim 33 has sulfuric acid groups. The Z group in copending claim 28 has a sulfuric acid group.

Sakaguchi et al. lists dicarboxylic acids that can be used to form the polyazole sulfonic acid groups and phosphonic acid groups in paragraph 0095 and paragraph 0101, respectively. The two aforementioned mentioned paragraphs only apply to how copending claim 28 read on currently considered claim 31. However, Sakaguchi et al. also mention that dicarboxylic acid having sulfonic acid group and phosphonic acid group may be copolymerized to synthesize the polyneazazole having sulfonic acid group and/or phosphonic acid group (paragraph 0108). Since copolymerization of dicarboxylic acids with sulfonic acids can be used to form the polymer membrane with the

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phosphonic acid groups, copending claim 28 reads on currently considered claim 33 as well.

Copending claims 29-31, 33-47, 49, 51, and 52 read on the currently considered claims 34-36, 39-53, 55, 57, and 58. As can be seen by the claim language, the scope of the claims is the same.

Copending claim 32 reads on currently considered claims 37 and 38. The difference lies in the acid group attached to the compounds. Currently considered claim 37 has phosphonic acid. Currently considered claim 38 has sulfonic acid. Copending claim 32 has sulfonic acid. Although none of the compounds are specifically taught, Sakaguchi et al. has mentioned that polymeric precursors with sulfonic and phosphonic groups may be copolymerized to synthesize a polybenzazole compound having sulfonic acid group and/or phosphonic acid group, as evidenced by his example of aromatic dicarboxylic acid groups (paragraph 0108). Therefore copending claim 32 reads on both currently considered claims 37 and 38.

Copending claims 37 and 38 read on currently considered 32. The difference lies in the acid group attached to the compounds. Copending claims 37 has phosphonic acid. Copending claim 38 has sulfonic acid. Currently considered claim 32 has sulfonic acid. Although none of the compounds are specifically taught, Sakaguchi et al. has mentioned that polymeric precursors with sulfonic and phosphonic groups may be copolymerized to synthesize a polybenzazole compound having sulfonic acid group and/or phosphonic acid group, as evidenced by his example of aromatic

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dicarboxylic acid groups (paragraph 0108). Therefore both copending claims 37 and 38 read on currently considered claim 32.

Copending claims 48 and 50 read on the currently considered claims 54 and 56, respectively. The only difference is that the polyazole polymer membrane of copending claims 48 and 50 include sulfonic acid groups, while currently considered claims 54 and 56 include phosphonic acid groups (step A)). However, the polymer product has the same properties. As previously mentioned both groups exhibit excellent processability, durability, solvent resistance, mechanical properties, and ion conductivity where both acid groups satisfy the object of the invention of creating a polymer membrane (paragraph 0022). Therefore, an electrode with the different polymer coatings would have the same properties.

This is a provisional obviousness-type double patenting rejection.

Conclusion

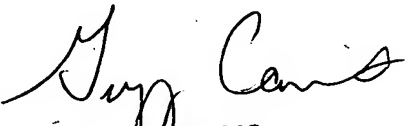
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Eugenia Wang whose telephone number is 571-272-4942. The examiner can normally be reached on 8 - 4:30 Mon. - Fri., EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Ryan can be reached on 571-272-1292. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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EW


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PRIMARY EXAMINER

18 June 2007